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"Identifying Environmental Features
for Land Management Decisions"



Center for Remote Sensing and Cartography
Applied Technology Division
University of Utah Research Institute
Salt Lake City, Utah



ADMINISTRATIVE MATTERS

This fourth year of this grant was one of significant change in the administrative structure of the Center for Remote Sensing and Cartography. On January 31, 1980, the Department of Geography at the University of Utah voted to "deinstitutionalize" remote sensing and eliminate the Center as a formal entity within the department.

During the ensuing months several alternative relocations for the Center were explored. Offers were extended from both of the other major universities in the state: Utah State University in Logan and Brigham Young University in Provo. Both are very strong in natural resource services, with active research in the Intermountain Region and elsewhere. And both are anxious to develop remote sensing as an applied research tool. Meanwhile, the University of Utah Research Institute (UURI) offered ideal space and dynamic administrative support to attract the Center.

Because of this support and the more central location of the University in Salt Lake City, we established the Center for Remote Sensing and Cartography at UURI at the foot of the Wasatch Mountains in the summer of 1980. The attached brochure is being revised to show CRSC as a branch of the Applied Technology Division. The enclosed single sheet flyer outlines the purpose, facilities, and key activities of the CRSC in its new location.

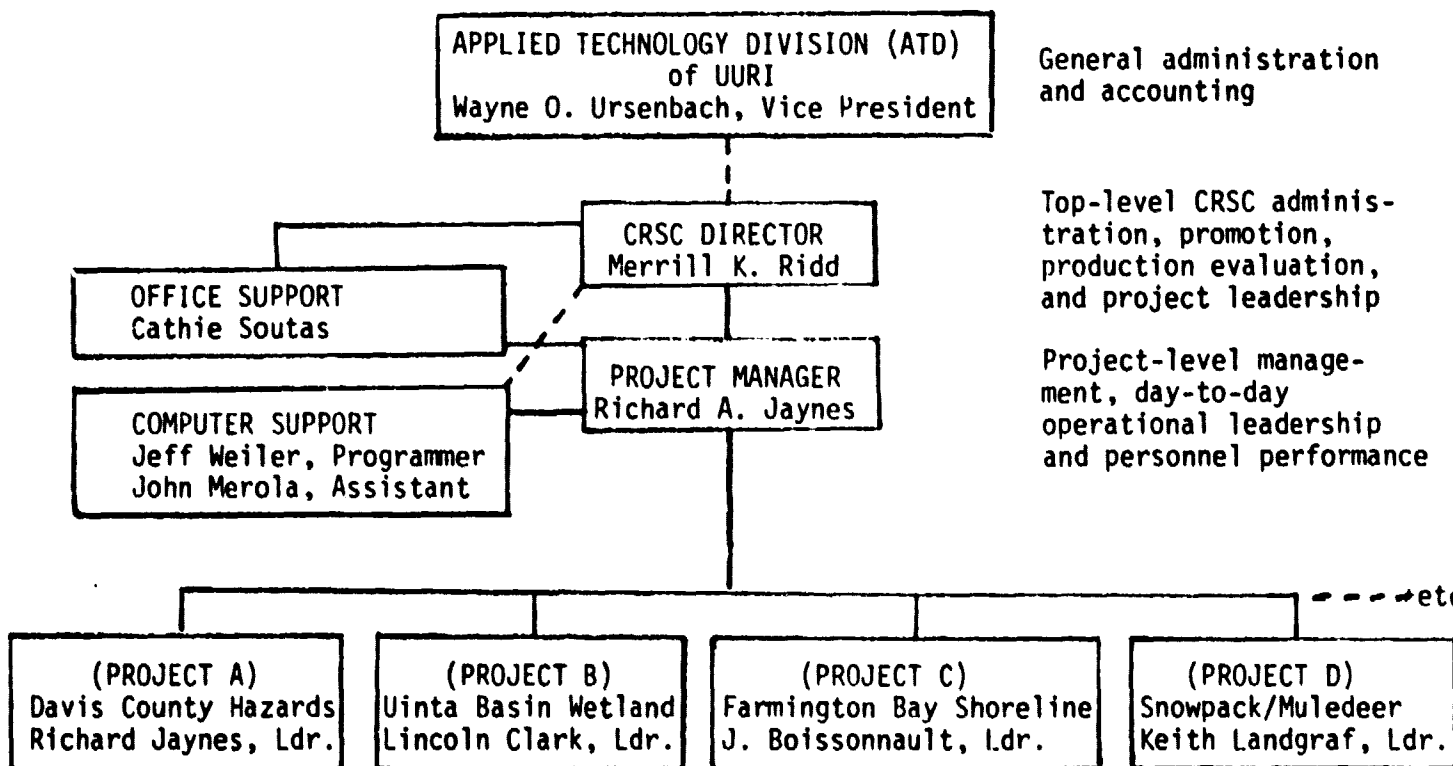
Staffing

In July CRSC announced a position for Project Manager. Some 20 applications were received, most of them after the ASP journal, "Photogrammetric Engineering and Remote Sensing" notice appeared in September. A dozen of the candidates were highly qualified and very acceptable candidates. On October 21, 1980, an offer was extended to and accepted by Richard A. Jaynes. Mr. Jaynes' credentials

include a B.S. degree in range science at Brigham Young University, an M.S. in watershed science at Utah State University, a law degree specializing in natural resources at the University of Utah, and years of experience in research throughout Utah, including employment with the Bureau of Land Management. His objective in pursuit of the law degree was to influence natural resource decision-making and management through scientific investigation and institutional action. His field experience in applied ecosystem investigations, his inside knowledge of institutional management structures, and his understanding of changing legal constraints prepare him uniquely for project management in applied research in resource management. His knowledge of the region, the region's resource problems and the key people involved, and his demonstrated record of intensive research and effective writing will be fundamental assets to CRSC and its performance.

Structure

The present administrative structure of CRSC is as follows:



At present only two CRSC employees are full-time -- Richard Jaynes and Jeff Weiler. Merrill Ridd is part-time consultant during the academic year, working 8 to 12 days per month (as his research activity from the University Department of Geography) but drawing a fee for only 2 days per month, thus providing substantial cost-sharing to all NASA and other project work and materially benefitting UURI; Cathie Soutas is half-time office manager; John Merola, Keith Landgraf, Lincoln Clark, and Joe Boissonnault are all part-time as student Research Assistants (RA's). Other help is hired as needed, and consultants are retained for large and small projects as needed where on-going staff support and expertise is unavailable. A growing pool of such specialists continues to broaden the experience and performance base of CRSC.

The transition period brought about by the administrative upheaval has caused a certain amount of delay and loss of efficiency in some of the project work. Only this week has the full administrative and personnel structure taken place, with the hiring of Mr. Jaynes. Beginning this week he has full responsibility for daily performance of all personnel and daily progress on all projects.

WORK PERFORMED DURING 1979-1980 PROJECT YEAR

Two major projects are in final stages at present -- the Uinta Basin Wetland study and the Davis County Foothill Hazard study. Another project, Farmington Bay (Great Salt Lake) Shoreline Fluctuation study, is being completed through Stage I.

Uinta Basin Wetland Study

In August, 1979, CRSC entered into an agreement with the Soil Conservation Service (SCS) and the Utah Division of Water Resources (DWR) to classify and map the wetlands and water-related land use in the Uinta Basin. SCS provided \$25,000 and DWR provided \$10,000. These funds were augmented by some \$5,000 in NASA funds in a joint effort. Lacking sufficient in-house staff, CRSC subcontracted

with a private consultant to perform some basic photo-interpretation work. Thirty-five quadrangles (1"24,000) are involved in the project.

The closing date on the contracts for this project is October 31, 1980. The work is being completed and the project final report written this week, on schedule. A full report will be submitted to NASA within a few weeks, upon acceptance and approval by the cooperating agencies. The work was completed on time, within budget, and actually superior in quality to the contract terms.

The contract called for the use of two techniques for the detection, classification, and mapping of wetlands and water-related land use. Manual photo-interpretation of U-2 color infrared photography was to serve as the "nuts & bolts" substance of the project, the basic assurance of quality and accuracy in classification and mapping. Digital Landsat data was to be experimentally applied to determine the extent to which such analysis might suffice in the classification and, in turn, perchance be used elsewhere as an efficient and cost-effective tool for wetland mapping.

The U-2 photography was made available through the cooperation of NASA-Ames. Flight date was August 1, 1979. The 24" lens was used on the bulk of the Basin (9" x 18" format at 1:30,000 scale). Near Vernal at the eastern end of the Basin in Ashley Valley, only 6" photography (9" x 9" at 1:130,000) was obtained. A Landsat CCT single date, single scene was obtained, covering virtually all the area, for the date August 5, 1979. This close association of dates was very beneficial.

Initial interpretations were made on U-2 CIR photography followed by field checks. Then, a series of innovations led to a powerful diagnostic tool. First, it was concluded that the U-2 CIR was far superior to conventional B/W photography used in the land use inventory ten years earlier. (Our subcontractor is the person who did the work a decade ago.) A second improvement in diagnosis came

when we used digital print maps to augment photo interpretations. A third and highly effective tool emerged when we photoreduced the Landsat digital print to a film positive at the same scale as the U-2 film. With the digital film overlain on the U-2 color film our speed and confidence in interpretation increased immediately. More significantly, our accuracy jumped perhaps 100% over the use of either CIR or digital interpretation alone. The simple process of merging the two techniques was amazingly effective.

As a result of this merging technique we found we could not only identify cover types more accurately, distinguishing pasture from alfalfa, etc., we could also make probabilistic statements about the relative amounts of water being consumed in one pasture vs. another. Likewise with alfalfa, not only could we separate it from other types more accurately, we could subclassify alfalfa as to relative amounts of water consumption. While the terms of this contract call only for mapping at the first level, we have proposed to the cooperating agencies that, inasmuch as the objective is water use, not just cover, we could do a successive study to really get at some meaningful water use data. There is a favorable response from both agencies as we have demonstrated the power of the merging technique.

The potential for resource action pay-off is not clear at this point (hence the limited investment by NASA); however, the expectation by the agency (esp. SCS) is that the impending decision on water re-allocation in certain laterals will benefit considerably from this data. A final report of the present project will be sent to NASA upon acceptance by the agencies. At that time an assessment will be made as to the degree of management pay-off and will be reported as well.

Davis County Foothill Hazard Study

In October, 1978, a comprehensive study was begun on the foothills of Davis County regarding the hazards to urban development on sensitive and unstable land.

Rapid urban expansion and scarce land for home sites is pushing subdivision into foothills where faulting, flooding, landsliding, and biological impacts are increasingly severe.

This multi-agency study is funded mostly by the Four Corners Regional Commission (\$63,000), with additional support from P.L. 208 funds (\$18,000), and contributed professional support from four state agencies, two federal agencies,

over the two years. Also, NASA U-2 CIR photography has been fundamental to the biological components as well as the geotechnical components of the study. A team of twenty geotechnical and biological and land planning specialists are engaged in a very comprehensive, interactive investigation carefully coordinated to assure (1) integration of all biophysical data and findings, and (2) translation of all technical findings into implementable language and ordinances. The study is under the general and technical supervision of Merrill K. Ridd, with Richard A. Jaynes as lead hydrologist, assistant administrator, and co-author of ordinances.

The technical investigations have now been completed. A series of meetings has been held with all special interest groups (whom we identify as the Advisory Committee) and elected commissioners and mayors (our Executive Committee). Concurrently an Ordinance Preparation Committee has been interacting at all meetings and with the technical teams to build a model ordinance to be adopted at the conclusion of the study by the nine municipalities and the county as their "Hillside Development Ordinance". Thus, the study has a "built-in" action payoff to the extent the ten administrative units accept the work. We are optimistic that they will, because we have cycled them into the study from the beginning and made them a party to the investigation. The towns are all supportive of the study and encouraged at the prospective outcome.

The study is being completed November 30, 1980. Following review by the

Four Corners Regional Commission and acceptance by the towns and county, the final report and documentation (including ten thematic maps at 1:24,000 scale) will be available December 31, 1980.

Farmington Bay Shoreline Fluctuation Study

A study begun two years ago has been divided into two stages to clarify goals and complete specific steps. Stage I, a mapping of shoreline fluctuations in the Farmington Bay is being completed this week. This phase has utilized Landsat digital data to detect and map the land-water interface (shoreline) through four feet of vertical fluctuation since the launch of Landsat 1 in July, 1972. The lakelines mapped are at levels 4198, 4199, 4200, 4201, and 4202 feet above sea level. The perimeter of the bay has been divided into 8 units and acreages have been measured for each of the four increments of change.

The data from this stage, and the maps, have been used as prime documentation already by the Division of Wildlife Resources (DWR) in a hearing at the State Capitol regarding a proposal to convert Farmington Bay into a fresh water body. The proposal would be devastating to areas of waterfowl habitat. The digital print maps, scaled to 1:24,000, were used for display in the hearing to demonstrate, for the first time, the actual location of the shoreline at various levels of the lake. The DWR officials were successful by using the set of digital maps in turning back the proposal -- for now at least. The maps were the principal document used in the hearing, leading to the staving off of the proposal.

WORK FOR THE COMING YEAR (1980-1981)

For the year now underway, the immediate task is to complete the final reports, documents, and maps for the three projects just described. These will all be done in one week to two months, as indicated. We feel that these will

demonstrate not only the completion of three very effective projects with high visibility and pay-off, but will also demonstrate significant technical innovation and growth.

Other work for the year will include Stage II of the Farmington Bay study on Great Salt Lake, renewal of a former study of snowpack and muledeer, a Sevier River Basin wetland study, and hopefully a couple of new studies through the Forest Service and other agencies.

Farmington Bay Stage II Study

The objective of Stage II is to evaluate waterfowl habitat as impacted by the fluctuating lake levels of Stage I. This component of our study has lagged unfortunately during this past year of administrative revision. We have met with the agency and they describe impending physical work on the area to improve habitat for waterfowl. The work involves modification of terrain for water impoundment and vegetative control. With renewed strength of staff we will bring this study to fruition this year.

Snowpack/Muledeer Study

This study, begun two years ago, was set aside for the past year in pursuit of other work, as we waited for Landsat data. The objective is to determine the correlation between snowline, as observed on Landsat B/W imagery, and deer mortality and hence, population of the herd and, in turn, as such conditions might influence decisions about the deer hunt regulations for the following October.

Sevier River Wetland Study

On the heels of the Uinta Basin Study, the Soil Conservation Service has requested a similar project in the Upper Sevier River Basin. This week we signed a contract for \$23,000 to perform such a study to be completed by September 30, 1981. We will need to obtain U-2 CIR photography for the project to do the quality of work demonstrated in the Uinta Basin and anticipated in the Upper

Sevier. We would appreciate support from the Space Applications Office at NASA headquarters in receiving the necessary U-2 photography.

Other Projects

CRSC is currently exploring several other project possibilities with State, federal, and local agencies. In all possible cases we will continue to pursue funding from the cooperating agencies to increase our base-flow of fiscal resources. We are optimistic about a number of possibilities.

OPERATION OUTREACH

The past year has had some unpredictable turns. However, the net effect at this reading is that, as things have now settled out, a tremendous new opportunity lies ahead. We are no longer encumbered by the whims of academic demartmental regulation and limitation.

Our first task is to pull the staff together under a new banner, with new full-time strength and continuity. Next week we plan to assemble a list of potential project applications, cooperating agencies, and potential funding sources. Following that, we plan to organize a systematic series of demonstrations, displays, and workshops -- bringing agency people through our new facilities, and reaching out to their offices to extend our presence in the State (and region). The first outreach workshop will be on November 25, 1980 with a group of agency people in the Uinta Basin. Others will follow, at many scales on many themes. We feel we have now established a sound basis for continued growth and continued innovation of improved and extended remote sensing application.